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Watanabe

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(54) **DEVELOPING DEVICE HAVING OVERLAPPING SEAL MEMBERS, AND PROCESS CARTRIDGE**

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G03G 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/0898*** (2013.01)

(58) **Field of Classification Search**
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USPC 399/103
See application file for complete search history.

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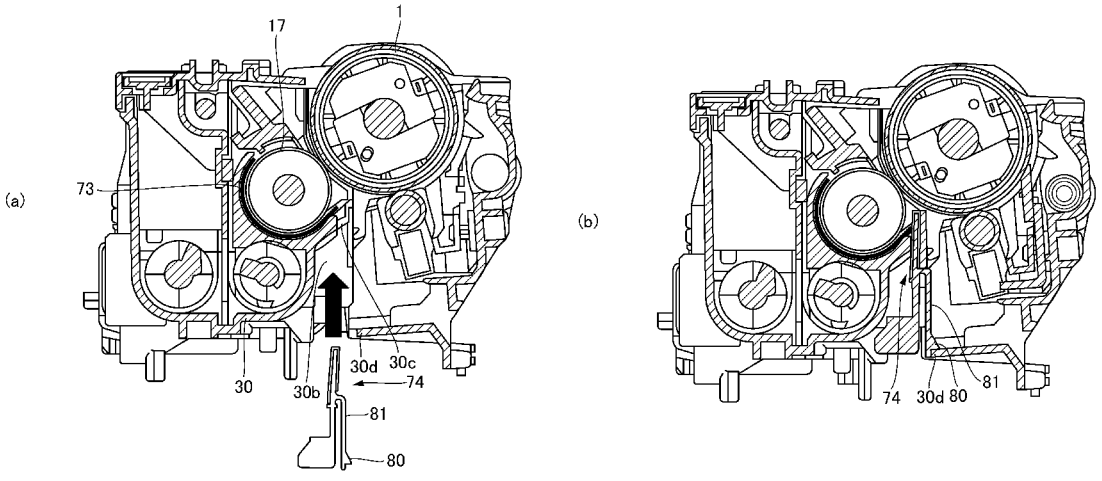
(57) **ABSTRACT**

A developing device includes a developer carrying member, a developing container, a pair of first seal members provided at end portions of the developer carrying member along a circumferential direction of the developer carrying member so as to contact the developer carrying member, and a pair of second seal members configured to seal the end portions of the developer carrying member. The second seal members are provided at overlapping positions with the first seal members with respect to a circumferential surface of the developer carrying member and an axial direction of the developer carrying member. The second seal members are mountable in a direction crossing the axial direction of the developer carrying member and into a main assembly of an image forming apparatus in a state in which the developer carrying member is mounted in the image forming apparatus.

6 Claims, 8 Drawing Sheets



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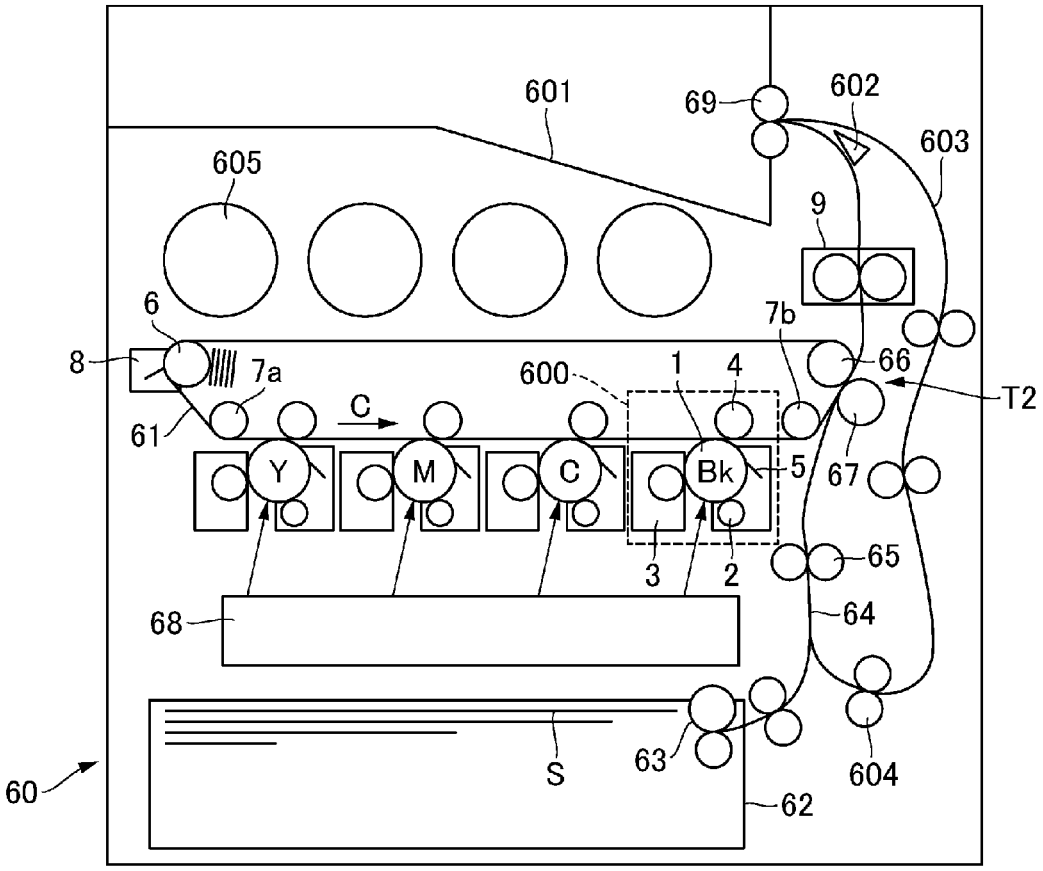
601
69
602
603
605
9
6
7b
8
7a
600
1
4
66
T2
C
61
Y
M
C
Bk
5
67
3
2
65
68
64
S
63
604
60
62

Fig. 1

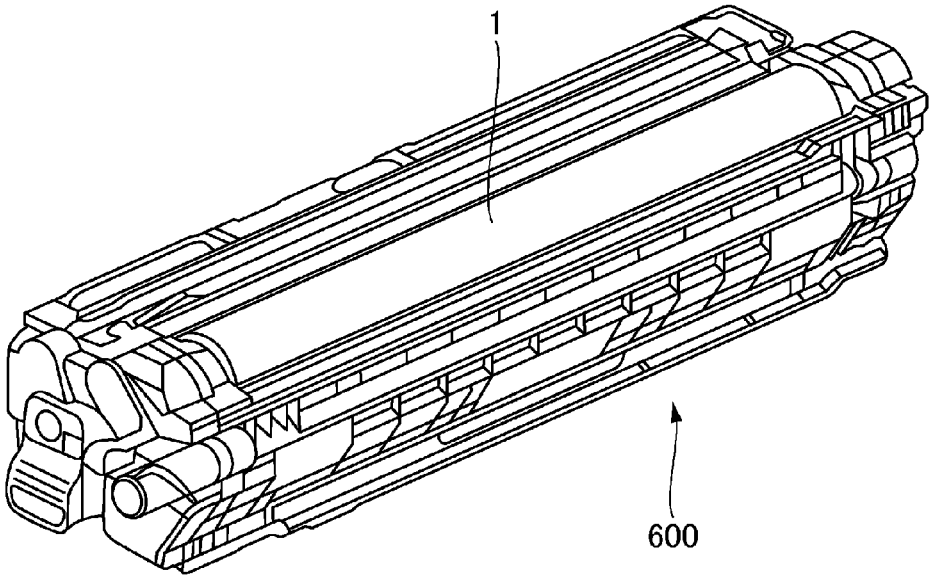

Fig. 2

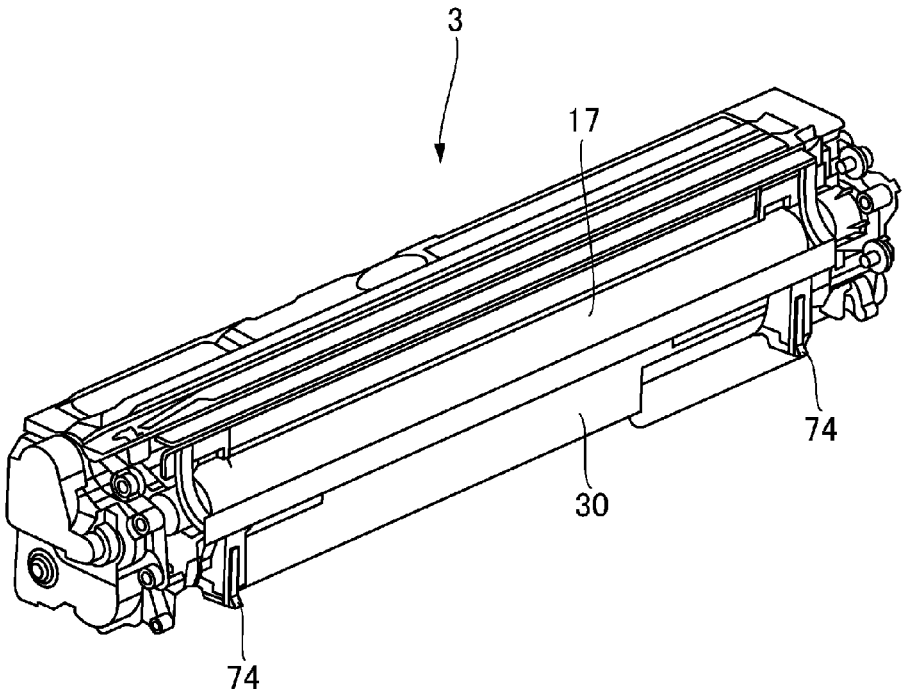

Fig. 3

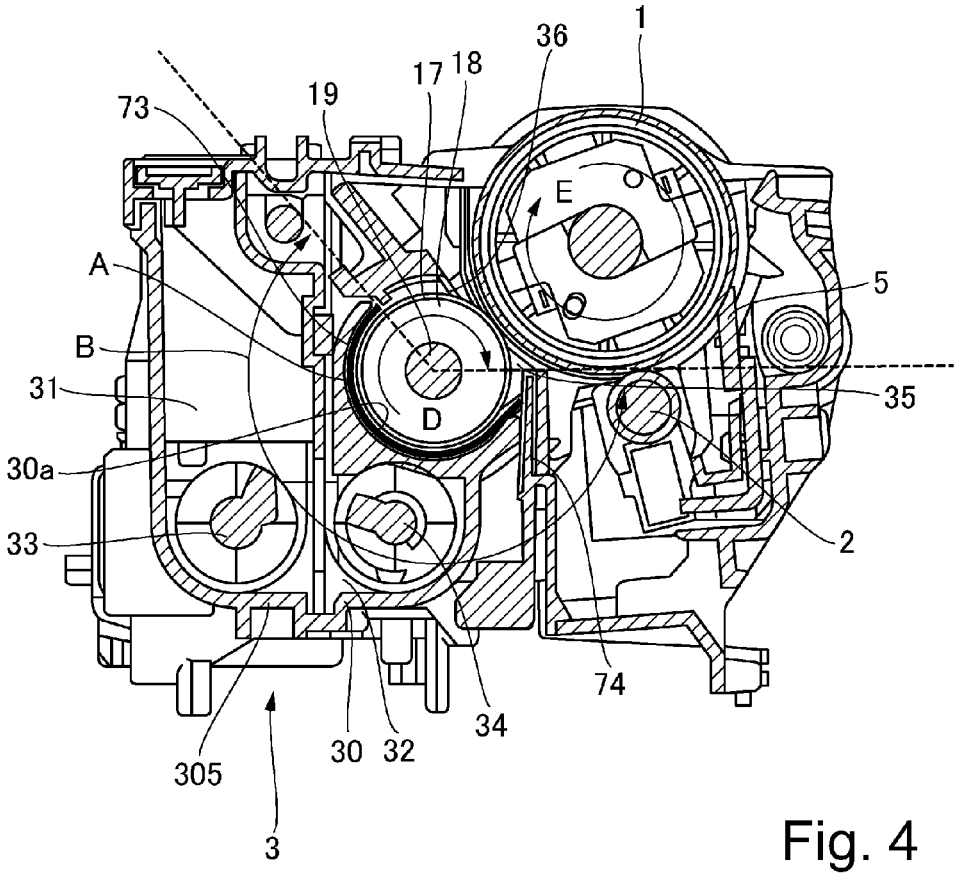
1
36
17
18
19
73
E
A
5
B
31
D
35
30a
33
2
74
34
30
32
305
3

Fig. 4

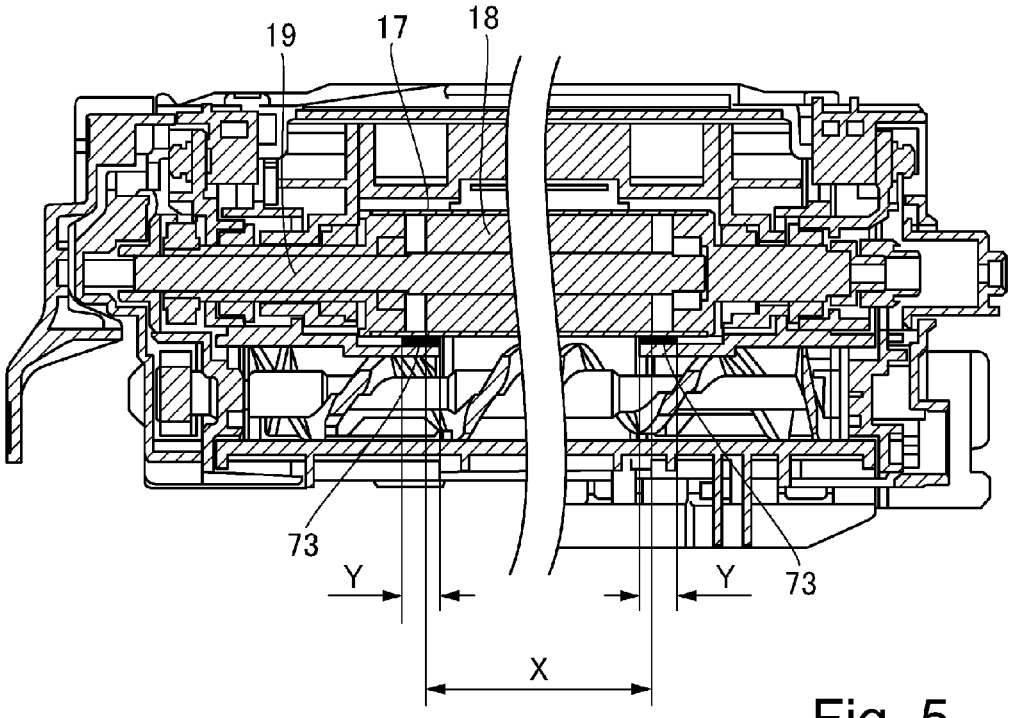
19
17
18
73
Y
Y
73
X

Fig. 5

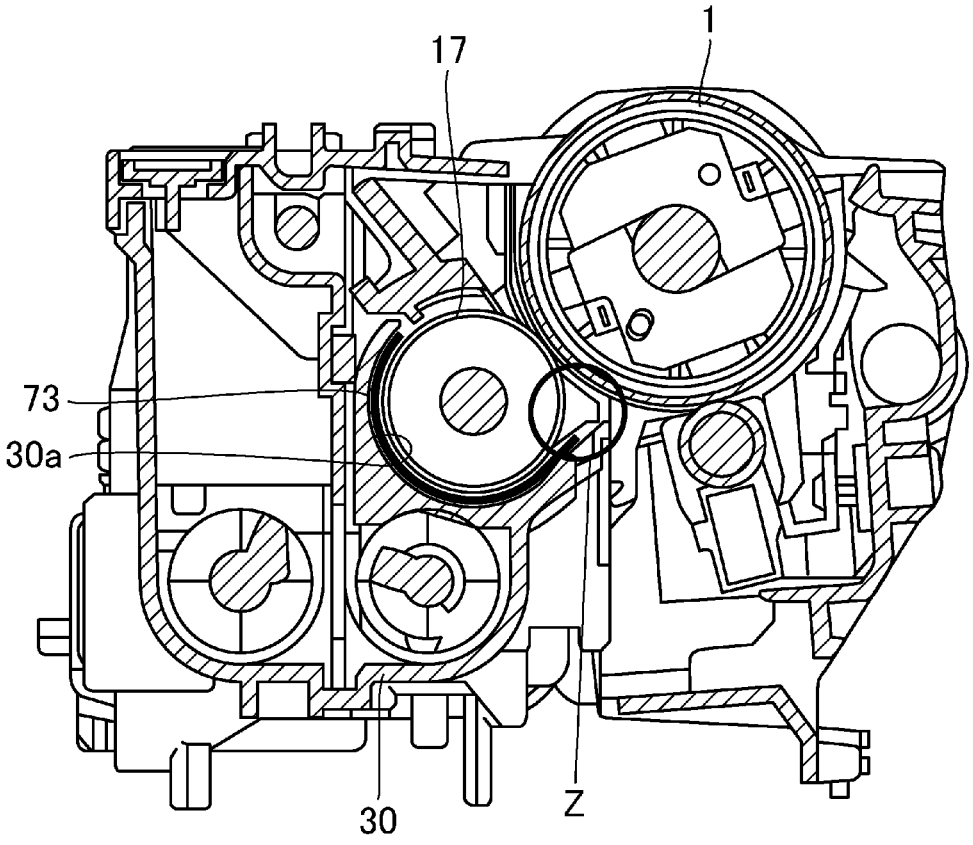

Fig. 6

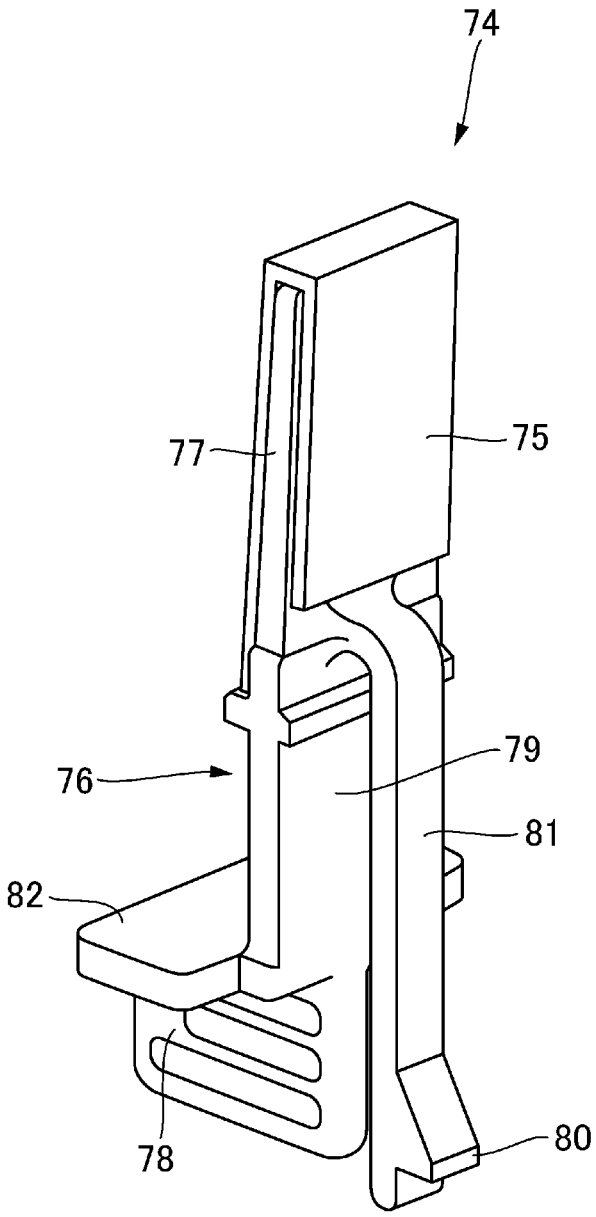

Fig. 7

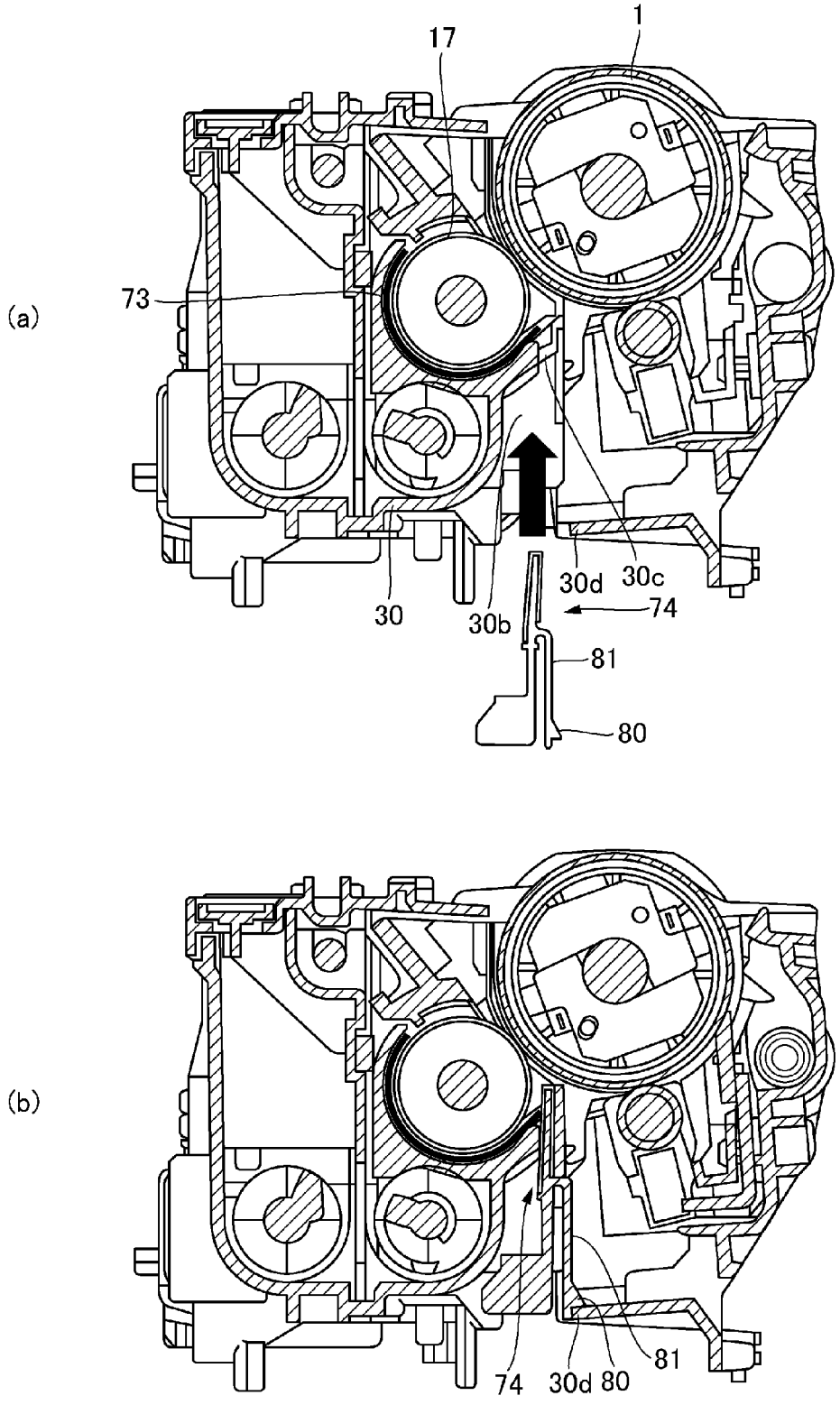

Fig. 8

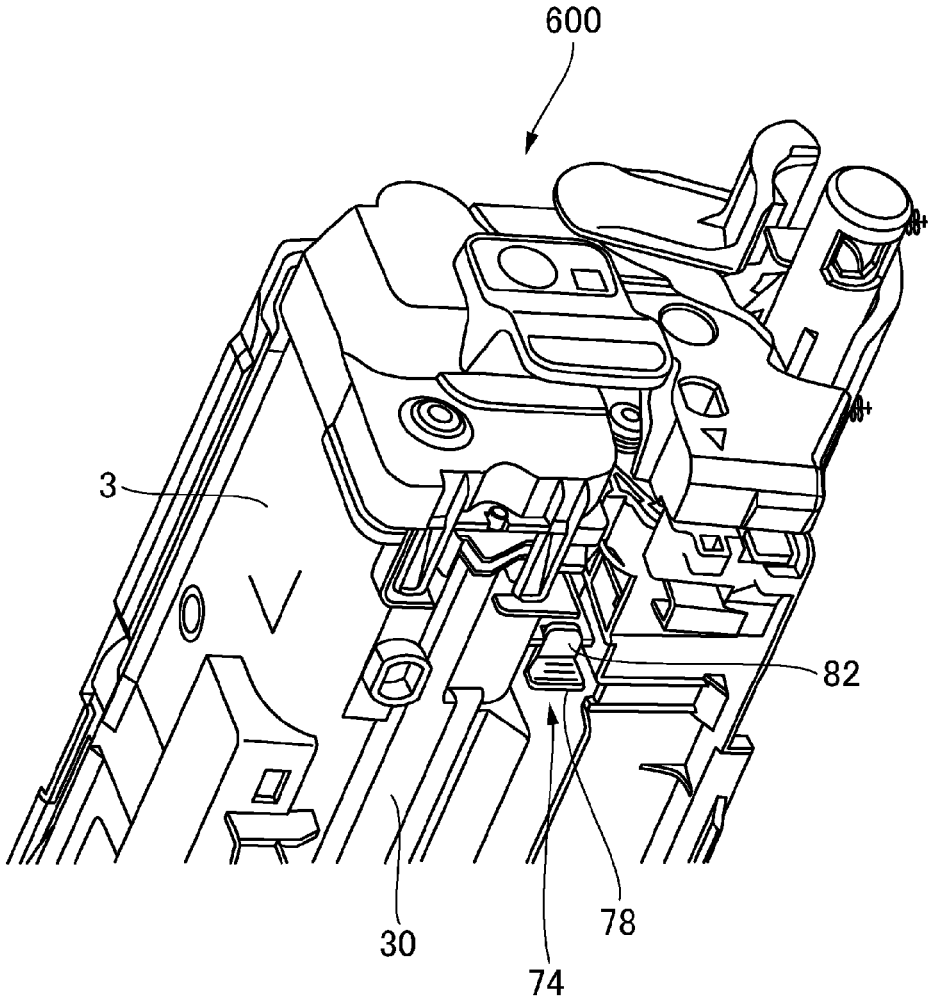

Fig. 9

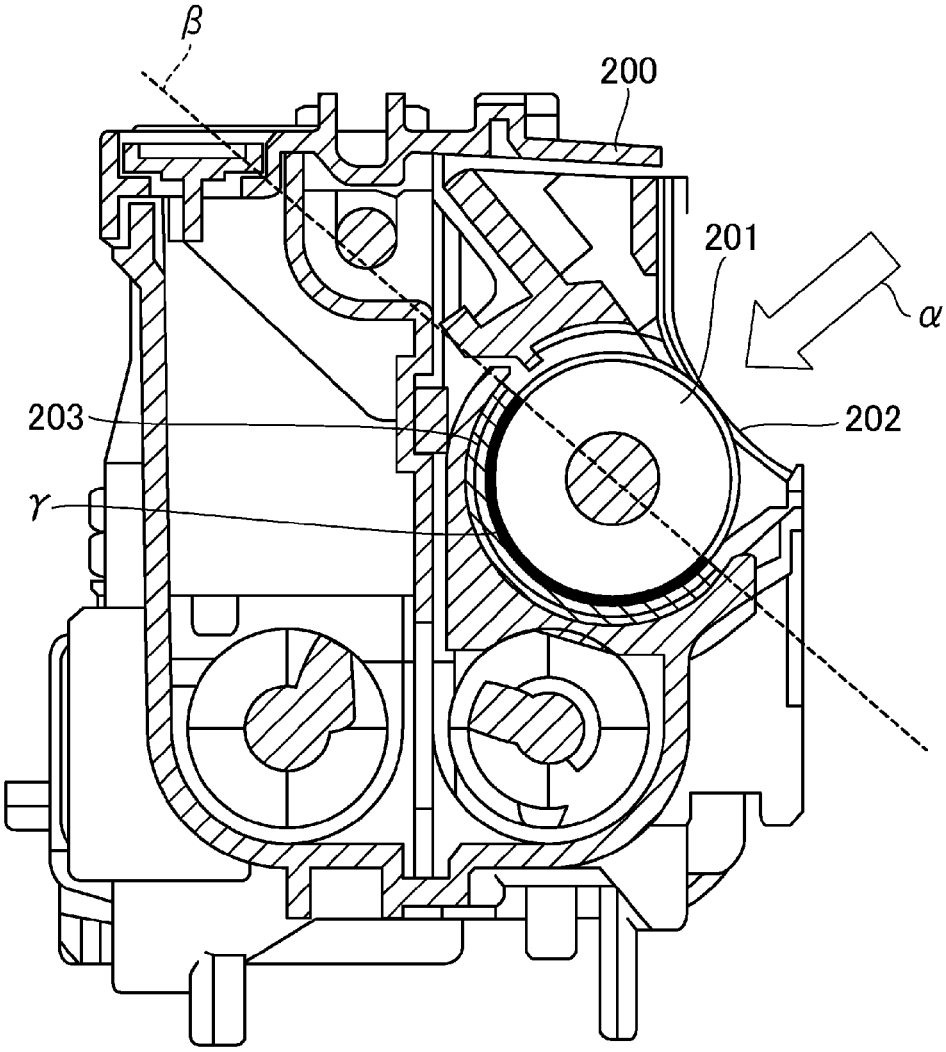

Fig. 10

DEVELOPING DEVICE HAVING OVERLAPPING SEAL MEMBERS, AND PROCESS CARTRIDGE

FIELD OF THE INVENTION AND RELATED ART

The present invention relates to a developing device for developing an electrostatic latent image formed on an image bearing member and a process cartridge including the image bearing member and the developing device.

In an image forming apparatus, the electrostatic latent image is formed on a photosensitive drum as an image bearing member, and there is developed by the developing device with a developer, e.g., containing a toner and a carrier, so that a toner image is formed on the photosensitive drum. The developing device includes a developing sleeve for feeding such developer while carrying the developer and carries the developer by a magnetic force of a magnet provided in the developing sleeve. Here, in a developing sleeve end portion side as a magnet end portion position, the magnetic force by the magnet is lowered and therefore the developer is liable to scatter. For this reason, a structure in which leakage of the developer from the developing sleeve end portion side is suppressed by sealing the developing sleeve in the end portion side of the developing sleeve has been conventionally known (Japanese Laid-Open Patent Application (JP-A) 2012-159828 corresponding to U.S. Patent Application Publication No. US 2012/0177401).

However, in the case where the seal is disposed at the developing sleeve end portion side, when the developing sleeve is mounted in a developing container, a sealable range is 180 degrees or less. This will be described with reference to FIG. **10**. A developing container **200** is provided with an opening **202**, in a region opposing an unshown photosensitive drum, through which a developing sleeve **201** is capable of being freely inserted. The insertion of the developing sleeve **201** into the developing container **200** is carried out from an arrow α direction in FIG. **10**. For this reason, in order to cause the developing sleeve **201** to pass through the opening **202** to reach a predetermined position in the developing container **200**, a space having a range of 180 degrees with respect to a circumferential direction shown by a broken line β in FIG. **10** is needed. As a result, a seal member **203** for sealing the developing sleeve **201** in the end portion side is provided within a range γ shown by a solid black portion in FIG. **10**. In this way, when a range in which the seal member for sealing the developing sleeve in the end portion side can be disposed is limited, leakage of the developer cannot be sufficiently suppressed.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide a developing device and a process cartridge which are capable of sufficiently suppressing leakage of a developer without impairing a developing sleeve mounting property in view of the above-described circumstances.

According to an aspect of the present invention, there is provided a developing device comprising: a developer carrying member for carrying and feeding a developer to a developing position, opposing an image bearing member, where an electrostatic latent image formed on the image bearing member is to be developed; a developing container for rotatably supporting the developer carrying member and for accommodating the developer to be supplied to the developer carrying member; a pair of first seal members provided at end portions of the developer carrying member along a circumferential direction of the developer carrying member so as to contact the developer carrying member in a side opposite from a side where the developer carrying member opposes the image bearing member; and a pair of second seal members provided at the end portions of the developer carrying member adjacent to the first seal members in a side which is downstream of the developing position and which is upstream of the first seal members with respect to a rotational direction of the developer carrying member, wherein the second seal members contact a surface of the developer carrying member.

According to another aspect of the present invention, there is provided a process cartridge comprising: an image bearing member for bearing an image; and the developing device described above.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic sectional view showing a structure of an image forming apparatus in an Embodiment of the present invention.

FIG. **2** is a perspective view of a process cartridge according to the Embodiment.

FIG. **3** is a developing device according to the Embodiment.

FIG. **4** is a cross-sectional view of the process cartridge according to the Embodiment.

FIG. **5** is a longitudinal sectional view, showing the process cartridge by parting omitting the process cartridge, for illustrating a longitudinal position of first seal members.

FIG. **6** is a cross-sectional view of the process cartridge provided with only the first seal member.

FIG. **7** is a perspective view of a second seal member in the Embodiment.

In FIG. **8**, (*a*) and (*b*) are cross-sectional views, of the process cartridge, showing states of the second seal member before and after mounting, respectively.

FIG. **9** is a partial perspective view showing the process cartridge in which the second seal member is mounted.

FIG. **10** is a cross-sectional view of a developing device for illustrating the reason why a seal range of a seal member is limited.

DESCRIPTION OF THE EMBODIMENTS

An embodiment of the present invention will be described with reference to FIGS. **1** to **9**. First, a general structure of an image forming apparatus in this embodiment will be described with reference to FIG. **1**. Incidentally, the image forming apparatus in this embodiment is a printer, a copying machine, a facsimile machine, a multi-function machine having a plurality of functions of these machines, and the like. A structure shown in FIG. **1** is a color image forming apparatus of an electrophotographic type.

[Image Forming Apparatus]

An image forming apparatus **60** has a structure of a so-called intermediary transfer tandem type in which image forming portions for four colors are provided opposed to an intermediary transfer belt **61** as an intermediary transfer member. The intermediary transfer tandem type is a main-

stream constitution in recent years from a viewpoint of high productivity and a viewpoint that it can meet feeding of various media.

[Feeding Process of Recording Material]

A recording material S which is a sheet material such as a sheet (paper) or an OHP sheet is accommodated in a recording material storage (cassette) **62** in a stacked manner, and is fed to a feeding path **64** as a recording material feeding path by a feeding roller **63** as a feeding means by being timed to image formation. The recording material S fed by the feeding roller **63** is fed to a registration roller **65** provided in a halfway position of the feeding path **64**. Then, oblique movement correction and timing correction of the recording material S are made by the registration roller **65**, and thereafter the recording material S is fed to a secondary transfer portion T**2**. The secondary transfer portion T**2** is a transfer nip formed by opposing rollers consisting of an inner secondary transfer roller **66** and an outer secondary transfer roller **67**, and a toner image is attracted to the recording material S by applying a predetermined pressure and a predetermined electrostatic load bias.

[Image Forming Portion]

The feeding process of the recording material

S to the secondary transfer portion T**2** is described above. An image forming process of an image sent to the secondary transfer portion T**2** at the same timing will be described. The process cartridge **600** as each of the image forming portions is constituted principally by a photosensitive drum (photosensitive member) **1** as an image bearing member, a charging device **2**, a developing device **3**, a primary transfer device **4**, a drum cleaner **5** and the like. Incidentally, the process cartridges for respective colors basically have the same constitution, and therefore. In FIG. **1**, only components of the process cartridge **600** for black (Bk) are represented by reference numbers or symbols and other process cartridges will be omitted from description.

A surface of the photosensitive drum **1** to be rotationally driven is electrically charged uniformly in advance by the charging device **2**, and then an electrostatic latent image is formed by an exposure device **68** driven on the basis of an image information signal. Next, the electrostatic latent image formed on the photosensitive drum **1** is subjected to development with a toner by the developing device to be visualized. That is, the developing device **3** develops the electrostatic latent image with the toner as the developer, so that a toner image is formed on the photosensitive drum **1**. Thereafter, the toner image formed on the photosensitive drum **1** is primary-transferred onto the intermediary transfer belt **61** by providing a predetermined pressure and a predetermined electrostatic load bias by a primary transfer device **4**. A transfer residual toner remaining on the photosensitive drum **1** in a slight amount after the transfer is collected by the drum cleaner **5**, and then is subjected to a subsequent image forming process.

The image forming process described above is performed by each of the process cartridges **600** of the respective colors of yellow (Y), magenta (M), cyan (C) and black (Bk). However, the number of the colors is not limited to 4, and also the order of arrangement of these portions of the respective colors is not limited to the above order.

Next, the intermediary transfer belt **61** will be described. The intermediary transfer belt **61** is stretched by a tension roller **6**, the inner secondary transfer roller **66** and follower rollers **7***a* and **7***b*, and is an endless belt to be fed and driven in an arrow C direction in FIG. **1**. Here, the inner secondary transfer roller **66** also functions as a driving roller for driving the intermediary transfer belt **61**. The image forming processes, for the respective colors, to be performed in parallel by the above-described process cartridges **600** of the respective colors are performed at timing when the toner images are successively superposed on the upstream color toner images primary-transferred onto the intermediary transfer belt **61**. As a result, a fall-color toner image is finally formed on the intermediary transfer belt **61** and then is fed to the secondary transfer portion T**2**. Incidentally, a transfer residual toner passing through the secondary transfer portion T**2** is collected by a transfer cleaner device **8**.

[Process of Secondary Transfer and Subsequent Steps]

By the feeding process and the image forming process which are described above, respectively, timing of the recording material S and timing of the full-color toner image coincide with each other at the secondary transfer portion T**2**, where secondary transfer of the toner images from the intermediary transfer belt **61** onto the recording material S is effected. Thereafter, the recording material S is fed to a fixing device **9**, where the toner image is melted and fixed on the recording material S by predetermined pressure and heat quantity. The thus image-fixed recording material S is subjected to selection such that the recording material S is discharged onto a discharge tray **601** as it is by normal rotation of a discharging roller **69** or is subjected to double-side image formation.

In the case where there is a need to effect the double-side image formation, after a trailing end of the recording material S is fed until it passes through a switching member **602** by the normal rotation of the discharging roller **69**, by reversely rotating the discharging roller **69**, a leading end and the trailing end of the recording material S are interchanged and then the recording material S is fed to a feeding path **603** for the double-side image formation. Thereafter, the recording material S is fed again to the feeding path **64** by a feeding roller **604** for re-feeding by being timed to a recording material, in a subsequent job, to be fed by the feeding roller **63**. Subsequent feeding and image forming processes for the image formation on the back (second) surface are the same as those described above.

[Process Cartridge and Developing Device]

Next, the process cartridge **600** and the developing device **3** in this embodiment will be described with reference to FIGS. **2** to **4**. The process cartridge **600** is constituted as shown in FIGS. **2** and **4** and includes the developing device as shown in FIG. **3**. In the developing device **3**, as a developer, a two-change developer obtained by mixing a non-magnetic toner and a magnetic carrier is used. The toner for each of the colors is supplied from a toner cartridge **605** (FIG. **1**) set in the image forming apparatus **60** into a developing container **30** of the developing device **3** via an unshown toner feeding path.

The developing device **3** includes the developing container **30** for accommodating the developer. In the developing container **30**, a first feeding chamber **31** and a second feeding chamber **32** which are partitioned by a partition wall are provided and are connected with each other at their end portions with respect to a longitudinal direction. A first feeding screw **33** and a second feeding screw **34** are rotatably supported in the first feeding chamber **31** and the second feeding chamber **32**, respectively, and are driven to circulate the toner, fed in the process cartridge **30**, through the two feeding chambers. Here, the magnetic carrier is contained in advance in the developing container **30**, and the toner is sufficiently stirred with the magnetic carrier during the circulation in the first feeding chamber **31** to be triboelectrically charged, so that the toner and the magnetic carrier are fed to the second feeding chamber **32**.

The second feeding screw **34** in the second feeding chamber **32** is disposed opposed to a cylindrical developing sleeve **17** and feeds and supplies the toner deposited on the magnetic carrier by the triboelectric charge with the magnetic carrier. The developing sleeve **17** is rotatably supported in substantially parallel to the photosensitive drum **1** at a predetermined position in the developing container **30**, and carries and feeds the developer by being rotationally driven by an unshown driving source. In the developing sleeve **17**, a magnet portion **18** for carrying the developer on the developing sleeve **17** is provided along a rotational axis direction (longitudinal direction) of the developing sleeve **17**. The magnet portion **18** is supported in an unrotatable manner so as to fix a magnetic pole pattern at a predetermined phase with respect to a circumferential direction in order to generate a desired magnetic field, and the developing sleeve **17** rotates around the magnet portion **18**.

The thus-constituted developing sleeve **17** carries the magnetic carrier, in a chain shape on a surface thereof by a magnetic force of the magnet portion **18**, on which the toner supplied from the second feeding screw **34** is deposited by triboelectric charge. Then, by rotation, the developing sleeve **17** feeds the toner and the carrier in the arrow D direction in FIG. **4**. Incidentally, in this embodiment, the rotational direction D of the developing sleeve **17** is set so as to be counter-directional to the rotational direction E of the photosensitive drum **1**, but may also be set so as to be the same direction as the rotational direction E of the photosensitive drum **1**.

The developing container **30** is provided with an opening **35** in a region where the developing sleeve **17** opposes the photosensitive drum **1**. At the opening **35**, the developing sleeve **17** is formed in an insertable manner. The developing container **30** supports the developing sleeve **17** so that the developing sleeve **17** is partly exposed to the opening **35** at the predetermined position described above. A layer thickness of the developer, consisting of the toner and the carrier, carried and fed to the developing sleeve **17** as described above is regulated by a regulating blade **36** provided in the neighborhood of the opening **35**, so that the developer is fed to a developing region where the developing sleeve **17** and the photosensitive drum **1** are close to and oppose each other. In the developing region, by applying a developing bias between the developing sleeve **17** and the photosensitive drum **1**, the electrostatic latent image formed on the photosensitive drum **1** is developed with the developer of which layer thickness is regulated as described above.

[First Seal Member]

A first seal member **73** for sealing a part of the developing sleeve **17** in an end portion side of the developing sleeve **17** in this embodiment will be described with reference to FIGS. **4** to **6**. The first seal member **73** is provided, between a part of the developing sleeve **17** and the developing container **30**, in a seal range A of 180 degrees or less with respect to a circumferential direction of the developing sleeve **17** so that the developing sleeve **17** can pass through the opening **35** and is mountable at the above-described predetermined position. In this seal range A, the first seal member **73** suppresses leakage of the developer. In the case of this embodiment, the seal range A is such a range that the first seal member **73** contacts a peripheral surface of the developing sleeve **17** as shown by a solid black portion in FIG. **4**. Accordingly, a length itself of the first seal member **73** may also exceed 180 degrees if insertion of the developing sleeve **17** described later is not prevented and if there is no functional problem such as interference with each member.

In this embodiment, the first seal member **73** is, as shown in FIG. **5**, provided in each of end portion sides of the developing sleeve **17**. Further, as shown in FIG. **4**, the seal range A of each of the first seal members **73** is 180 degrees. For this reason, each of the first seal members **73** is formed with a band-like member having a length in which the first seal member **73** can cover the peripheral surface of the developing sleeve **17** in a range of 180 degrees.

The first seal member **73** is contacted to a part of the peripheral surface of the developing sleeve **17** at one surface thereof, and is fixed, at an opposite surface (the other surface) thereof, to a curved surface **30***a* of the developing container **30** opposing the part of the peripheral surface of the developing sleeve **17** by an adhesive such as a double-side tape. This curved surface **30***a* is positioned in a side opposite from the opening **35** via the developing sleeve **17**, and is formed along the part of the peripheral surface of the developing sleeve **17**. An interval between the curved surface **30***a* and the part of the peripheral surface of the developing sleeve **17** is substantially uniform over the circumferential direction in a range (180 degrees in this embodiment) in which the first seal member **73** contacts the peripheral surface of the developing sleeve **17**.

The developing sleeve **17** has a cylindrical surface, smoothly formed, at each of end portions thereof, and includes a developer carrying portion, inside the end portions, provided with projections and recesses at a surface thereof. For this reason, the first seal member **73** slides with the part of the peripheral of the developing sleeve **17** at each of the end portions of the developing sleeve **17** at the smooth cylindrical surface by rotation of the developing sleeve **17**. The first seal member **73** is constituted by a seal member which is not readily broken by friction and which has a low resilience.

The first seal member **73** is disposed at an overlapping position with each of rotational axis direction end portions of at least the magnet portion **18** with respect to a rotational axis direction (longitudinal direction, width direction or left-right direction in FIG. **4**). This will be described with reference to FIG. **5**. Inside the developing sleeve **17**, a fixing shaft **19** is provided so as to penetrate the developing sleeve **17** along the rotational axis direction, and on which the magnet portion **18** is fixed. The developing sleeve **17** is disposed rotatably relative to this fixing shaft **19**. A width direction dimension (left-right direction dimension in FIG. **5**) X of the magnet portion **18** at least has a length which is not less than an image forming region where the toner image is to be formed on the photosensitive drum **1**, and is shorter than a longitudinal direction dimension of the developing sleeve **17**.

The first seal member **73** is disposed at an overlapping position with each of the end portions of the magnet portion **18** disposed as described above. That is, as shown in FIG. **5**, within a width direction dimension Y of the first seal member **73**, an associated one of the end portions of the magnet portion **18** is positioned. As described above, at the end portion of the magnet portion **18**, the magnetic force is decreased, and therefore the toner is in a state in which the toner is liable to scatter relative to other portions. For this reason, a part of the developing sleeve **17** where the end portion of the magnet portion **18** decreasing in magnetic force is positioned is required to be mainly sealed. Accordingly, in this embodiment, the first seal member **73** is disposed as described above.

In the case of this embodiment, assembling of the first seal member **73** and the developing sleeve **17** with the developing container **30** is made in the following manner. First, the first seal member **73** is applied to the curved surface **30***a* of the developing container **30**. Then, the developing sleeve **17** is inserted into the developing container **30** from a direction perpendicular to the rotational axis direction of the developing sleeve **17** through the opening **35**, and then is supported and fixed at a predetermined position of the developing con-

tainer **30** so that the peripheral surface of the developing sleeve **17** in each of the end portion sides contacts the first seal member **73**. As a result, the developing sleeve **17** is sealed by the first seal member **73** in the range of 180 degrees at the peripheral surface thereof in each of the end portion sides as shown in FIG. **6**.

Here, the developer carried on the developing sleeve **17** by the magnetic force of the magnet portion **18** is transferred onto the photosensitive drum **1** disposed with a certain interval with the developing sleeve **17**, so that the toner image is formed. That is, in the developing region, the electrostatic latent image formed on the photosensitive drum **1** is developed with the developer carried on the developing sleeve **17**. The developer in an initial stage has a large charge amount, and therefore a transfer performance of the toner image onto the photosensitive drum **1** is good. However, the charge amount is decreased with deterioration of the developer and therefore also the transfer performance is gradually lowered. Then, the toner which is not transferred from the developing sleeve **17** onto the photosensitive drum **1**, i.e., the developer which is not used for development in the developing region is returned again to the developing device **3**. At this time, an untransferred toner returned again to the developing device **3** after passing through the surface of the photosensitive drum **1** passes through a region Z, where the developing sleeve **17** cannot be sealed with the first seal member **73**, in a downstream side of the developing region with respect to the rotational direction of the developing sleeve **17** as shown in FIG. **6**. This region Z is a region, of the peripheral region of the developing sleeve **17**, where the developing sleeve **17** cannot be sealed between the end portion of the first seal member **73** and the developing region by setting the seal range A of the first seal member **73** at 180 degrees or less as described above.

The toner which is not used for development in this way has a small charge amount and therefore is very liable to scatter. Further, in the neighborhood of each of the end portions, of the magnet portion **18** of the developing sleeve **17**, where the magnetic force is lowered, the toner is most liable to scatter. Therefore, in such a region **8** where the developing sleeve **17** cannot be sealed, the toner is liable to scatter. Particularly, with the deterioration of the toner, an amount of toner scattering from the region Z becomes large, so that contamination of a portion outside the process cartridge **600** occurs. Accordingly, it is important that the region E is blocked in order to further improve the sealing performance.

[Second Seal Member]

In this embodiment, the region Z, which is a portion where the developing sleeve **17** cannot be sealed, generated by limiting the seal range A of the first seal member **73** as described above is blocked by a second seal member **74**. That is, the second seal member **74** is disposed with respect to each of the pair of first seal members **73** disposed in the end portion sides of the developing sleeve **17**. This second seal member **74** will be described with reference to FIGS. **4**, **7** and **9**.

The second seal member **74** can be disposed after the developing sleeve **17** is mounted in the developing container **30**. The second seal member **74** is close to or contacts a pair of the developing sleeve **17** ends so as to extend the seal range A of the first seal member **73**. In this embodiment, as shown in FIG. **4**, the second seal member **74** is disposed so as to be close to a part of the peripheral surface of the developing sleeve **17**. By disposing the second seal member **74** in this way, the leakage of the developer is suppressed by setting a region B, where a part of the developing sleeve **17** is covered, at an angle which is larger than 180 degrees in combination with the seal range A of the first seal member **73**.

Description will be made specifically. First, the second seal member **74** is constituted so as to be detachably mountable to the developing container **30**, and as shown in FIG. **7**, is constituted by a seal material **75** and a seal holding member **76** on which the seal material **74** is mounted. The seal material **75** is formed in a band shape having a predetermined length, and is fixed so as to wind around a holding plate portion **77** provided at an intermediary portion or a free end portion of the seal holding member **76**. For this reason, the seal material **75** is provided, at one surface thereof, with an adhesive such as a double-side tape, and is wound around the holding plate portion **77** at the one surface thereof, whereby the seal material **75** is applied, at the one surface thereof, to the holding plate portion **77** so as to cover both surfaces of the holding plate portion **77**.

In this way, the seal material **75** fixed on the seal holding member **76** is close to a part of the developing sleeve **17**. The seal material **75** is disposed in the neighborhood of the developing sleeve **17**, and therefore it is preferable that a material which can suppress a rotational sliding resistance of the developing sleeve **17** in contact with the developing sleeve **17** and which has high breaking strength is used. For this reason, the material for the seal material **75** may preferably have a sliding property and low resilience, and specifically it is preferable that the seal material **75** is a pile material on which fibers are planted. Incidentally, the pile material may only be required to be provided at a portion, of the second seal member **74**, close to or contacting at least a part of the developing sleeve **17**. However, in this embodiment, the pile material is used as a whole of the seal material **75**, and the adhesive such as the double-side tape is provided on a back surface where fibers are not planted, and the seal material **75** is applied to the holding plate portion **77** at the back surface.

The seal holding member **76** for fixing the thus-constituted seal material **75** includes the holding plate portion **77** for fixing the seal material **75**, a grip portion **78** provided at a base end portion, a connecting portion **79** for connecting the holding plate portion **77** and the grip portion **78**, and a hooking portion **80**. In a connecting portion **79** side the grip portion **78**, a blocking plate portion **82** perpendicular to the connecting portion **79** is provided. Such a seal holding member **76** is formed by integral molding of these portions with a resin material or the like. The grip portion **78** is, as described later, a portion gripped by a user when the second seal member **74** is mounted to and dismounted from the developing container **30**. The hooking portion **80** is provided at a free end portion of an extended portion **81** extended from the intermediary portion of the seal holding member **76**, and is engaged with a part of the developing container **30** when the second seal member **74** is mounted in the developing container **30**. The mounting of the thus-constituted second seal member **74** into the developing container **30** is carried out as shown in FIG. **8**. In FIG. **8**, (*a*) shows a state before the mounting of the second seal member **74**, and (*b*) shows a state after the mounting of the second seal member **74**. First, the second seal member **74** is inserted from a direction shown in (*a*) of FIG. **8** by an arrow into a mounting space **30***b* provided in a part of the developing sleeve **30** to which the first seal member **73** and the developing sleeve **17** are mounted. At this time, the user performs an inserting operation while gripping the grip portion **78**. At a rear portion of the mounting space **30***b*, an inserting hole **30***c* through which a free end portion, of the second seal member **74**, where the seal material **75** is provided is freely inserted is formed.

Then, as shown in (*b*) of FIG. **8**, the second seal member **74** is inserted until the free end portion of the seal material **75** abuts against the inserting hole **30***c*, so that the hooking por-

tion **80** is engaged with an engaging portion **30***d* provided to the developing container **30**. At this time, the extended portion **81** is elastically formed, so that the hooking portion **80** passes through the engaging portion **30***d*. Thereafter, by an elastically restoring force of the extended portion **81**, the hooking portion **80** engages with the engaging portion **30***d* with reliability, thus preventing the second seal member **74** from dropping off from the developing container **30**. In this way, in a state in which the hooking portion **80** engages with the engaging portion **30***d*, the seal material **75** fills the gap of the inserting hole **30***c* and a part of the seal material **75** approaches a part of the developing sleeve **17**. Further, in a mounted state of the second seal member **74** to the developing container **30**, the free end of the seal material **75** approaches the photosensitive drum **1**. As a result, the above-described region Z is covered with the second seal member **74** in the opening side.

In the state in which the second seal member **74** is mounted to the developing container **30**, as shown in FIG. **9**, the grip portion **78** is exposed from the developing container **30**. For this reason, when the engagement between the hooking portion **80** and the engaging portion **30***d* is eliminated, the second seal member **74** can be disconnected from the developing container **30** while gripping the grip portion **78**. The inserting hole **30***c* is covered with a blocking plate portion **82** in the opening side, so that inclusion of a foreign matter in the inserting hole **30***c* is suppressed.

In the state in which the second seal member **74** is mounted in the developing container **30** in this way, a part of the seal material **75** contacts the end portion of the first seal member **73**. For this reason, in this embodiment, the second seal member **74** is disposed at an overlapping position with at least the first seal member **73**. That is, at the mounting position of the second seal member **74**, unless the second seal member **74** is connected with the first seal member **73** with reliability, generation of toner scattering cannot be suppressed sufficiently. For this reason, with respect to the position of the first seal member **73** disposed in each of the end sides of the developing sleeve **17**, the second seal member **74** is disposed at an overlapping position between ranges of width direction dimensions of the first and second seal members **73** and **74**. In a preferred example, the second seal member **74** is disposed so as to contact an entire end portion of the first seal member **73** with respect to the width direction.

In the case of the thus-constituted embodiment, the second seal member **74** disposed so that the region B in which the part of the developing sleeve **17** is covered in combination with the seal range A of the first seal member **73** is larger than 180 degrees by extending the seal range A is provided. For this reason, leakage of the developer can be sufficiently suppressed. That is, in order to mount the developing sleeve **17**, the seal range A of the first seal member **73** is limited to 180 degrees or less, and therefore a sealing effect by the first seal member **73** is not sufficient. For this reason, in this embodiment, the region which cannot be sealed by the first seal member **73**, i.e., the region Z in this embodiment is covered with the second seal member **74**, whereby an effect against the toner scattering can be further enhanced.

Further, the second seal member **74** can be disposed after the developing sleeve **17** is mounted in the developing container **30**. That is, the second seal member **74** can be mounted, after the first seal member **73** and the developing sleeve **17** are mounted in the developing container **30**, so as to cover the region Z through the inserting hole **30***c* as described above. For this reason, even when the region in which the part of the developing sleeve **17** is covered with the second seal member **74** becomes larger than 180 degrees, a mounting property of the developing sleeve **17** is not impaired.

Other Embodiments

In the above-described Embodiment, the first seal member **73** is the low resilient seal material to be contacted to the peripheral surface of the developing sleeve **17**, but the first seal member **73** may also have other seal constitutions such as a magnetic seal. In the case where the first seal member **73** is the magnetic seal, a magnetic sheet is fixed on the curved surface **30***a* spaced from the peripheral surface of the developing sleeve **17** by a predetermined interval. Thus, the magnetic seal is formed between the magnetic sheet and the peripheral surface of the developing sleeve **17**. In this case, the seal range A is a range in which the magnetic seal is formed in this way.

According to the present invention, the second seal member disposed so that the region in which the part of the developing sleeve is covered with the second seal member in combination with the seal range of the first seal member by extending the seal range of the first seal member is larger than 180 degrees is provided, and therefore leakage of the developer can be suppressed sufficiently. Further, the second seal member can be disposed after the developing sleeve is mounted in the developing container, and therefore even when the region in which the part of the developing sleeve is covered with the second seal member is larger than 180 degrees, the mounting property of the developing sleeve is not impaired.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

This application claims priority from Japanese Patent Application No. 192765/2013 filed Sep. 18, 2013, which is hereby incorporated by reference.

What is claimed is:

1. A developing device comprising:

a developer carrying member configured to carry and feed a developer to a developing position;

a developing container configured to rotatably support said developer carrying member and to accommodate the developer to be supplied to said developer carrying member;

a first seal member provided at one end portion of said developer carrying member along a circumferential direction of said developer carrying member so as to contact said developer carrying member, wherein

a first region sealed by said first seal member ranges 180 degrees or less with respect to the circumferential direction of said developer carrying member;

a second seal member, provided at the one end portion of said developer carrying member, configured to seal the one end portion of said developer carrying member, wherein said second seal member is provided at an overlapping position with said first seal member with respect to a circumferential surface of said developer carrying member and an axial direction of said developer carrying member,

wherein a seal region which is a sum of the first region and a second region sealed by said second seal member ranges more than 180 degrees with respect to the circumferential direction of said developer carrying member; and

a supporting member, provided detachably mountable to said developing container, configured to support said second seal member, said supporting member includes a plate-like extended portion provided so that a surface thereof opposes the circumferential surface of said developer carrying member,

wherein said second seal member is attached to said plate-like extended portion, and

wherein said supporting member is provided detachably mountable to said developing container in a direction in which the plate-like extended portion is extended.

2. A developing device according to claim **1**, wherein said developer carrying member is detachably mountable to a mounting position of said developing container with respect to a normal direction to said developer carrying member.

3. A developing device according to claim **1**, wherein said developer carrying member includes a magnet portion, provided therein along a rotational axis direction of said developer carrying member, for carrying the developer on said developer carrying member by a magnetic force, and

wherein each of said first seal members is disposed at a position where said first seal member overlaps with at least a rotational axis direction end portion of the magnet portion with respect to the rotational axis direction of said developer carrying member.

4. A developing device according to claim **1**, wherein said supporting member includes a locking portion configured to be locked with said developing container, and is detachably mountable to said developing container.

5. A developing device according to claim **1**, wherein said second seal member is constituted by a pile material, with at least a portion thereof contacting said developer carrying member.

6. A process cartridge comprising:

an image bearing member for bearing an image; and

a developing device according to claim **1**.

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